

Appendix B

**Appendix B—
Maintenance Plan**

APPENDIX B MAINTENANCE PLAN

INTRODUCTION

The greatest portion of maintenance will occur during the first 2 years following implementation of the restoration plan; however, maintenance will continue throughout the 5-year monitoring period. These activities will include watering, weeding, litter removal, removal and replacement of dead plants, and inspection and repair of the bioengineered structures and slopes. Additionally, maintenance activities in the restoration areas will be guided by the results of mitigation monitoring and may change throughout the duration of the monitoring and maintenance period in response to adaptive management measures prescribed by the City of Tacoma (City) and the Trustees. Assuming the restoration plan is implemented in the fall of 2000 or early spring of 2001, maintenance will be conducted at least through fall of 2005 or spring of 2006.

PLANTS

Watering

Depending on when native plants are installed, watering will likely be necessary through the summer drought period during the first growing season after installation. Watering will be sufficient to maintain adequate moisture in the root zone to allow successful growth and establishment of plantings. Watering will be required if soils feel dry when a finger is inserted into the soil around the base of plants. It is expected the contractor shall be responsible for watering all plants to ensure survival. Maintenance will require periodic inspection of the irrigation system to ensure proper functioning. A regular bimonthly maintenance schedule is recommended between mid-July and the end of October during the first growing season and possibly during the second growing season. The schedule will depend on whether there is an unusually long summer drought or if unseasonably dry conditions persist, such as more than 2 weeks without more than a trace of precipitation. Following the second complete growing season the temporary irrigation system can be removed. Only plants that are installed to replace dead plants will require watering following the second growing season in 2002. These plants can be watered using buckets or a backpack apparatus.

Weeding

Weeding around plantings will be important during the first and second year following installation to ensure successful establishment, particularly in the portions of planting zones where invasive species have been removed. Portions of planting zones 4, 5, 6, and 7, where reed canarygrass, Himalayan blackberry, English ivy, and Scot's broom have been removed and replaced by native plants, will be particularly important maintenance areas. These invasive species are likely to regrow from incompletely removed roots or from viable seed in the soil and can form dense communities capable of outcompeting native plants. In the first growing season following installation, weeding will occur at least once a month between April and November. A combination of cultural and chemical treatments, such as physical removal of weeds, mulching, and spot treatment of weeds with a glyphosate-based herbicide, will likely be the most successful techniques.

Because of concerns about herbicide toxicity to fish and aquatic life in Swan Creek and the Haire Wetland that may result from drift or overspray, only herbicides approved for use in aquatic environments by the Washington State Department of Ecology (Ecology) will be used (if at all). In addition, herbicides will be applied only according to manufacturer specifications by a licensed applicator and with proper approvals from all applicable agencies, including Ecology.

Weeding will also occur at least once near the beginning (March), middle (June), and end (October) of the growing season the second and third years after installation. More frequent weeding may be required depending on the growth rate of native plants and the rate of regrowth or reintroduction of invasive species. If the planting occurs in the fall of 2000 or spring of 2001, this schedule will be followed through 2003.

Following more intensive weed-removal efforts after the second full growing season, a less frequent weeding schedule should be sufficient to control invasive species. At a minimum, cultural and/or spot herbicide applications will be done in the beginning (March) and end (October) of the growing season the third through the fifth years following implementation of the restoration plan. In other words, weeding will be conducted according to this schedule from 2003 through 2005. More frequent weeding may be required in Zone 7 if reed canarygrass appears to be spreading or continuing to regrow and recolonize areas around plantings rapidly.

Except in areas where invasive species have been removed or aggressively regrown, weeding will be done using simple hand tools, (e.g., rakes, hoes, or machetes). In areas where Himalayan blackberry, reed canarygrass, or English ivy have regrown or recolonized and formed dense patches, mechanical weed-removal methods such as gas-powered weed eaters may be used to control weeds. The contractor and his/her employees will be trained and able to identify native plants to ensure these are not inadvertently removed during weeding. If native plants are accidentally removed, they will be replaced by the contractor at no cost to the City.

Litter Removal

Litter will be removed from all planting zones. Litter removal will occur at least monthly or according to a mutually agreed upon schedule established by the City and the Trustees. All litter removed from the site will be properly disposed of in a designated landfill or transfer station.

Dead Plant Material Removal

Dead plant material will be removed and replaced as directed following each mitigation monitoring event. This will allow the City and Trustees to evaluate the progress of the restoration and determine if adaptive management measures such as additional plantings are required to meet established performance standards. Removal and replacement of dead plants will be implemented as directed by the City and Trustees.

BIOENGINEERED STRUCTURES

Each bioengineered structure should be inspected bi-annually; once at the beginning and once at the end of each rainy season. The first inspection should take place after the first high flow condition, which usually occurs after a major storm event (1 inch of precipitation in a 24-hour period) or after an extended period of measurable precipitation (a 5-day period with measurable precipitation of > 0.3 inches/day). The second inspection should take place in mid-April to mid-May after consistent measurable precipitation has ceased.

Rootwads, Deflector Logs, Channel Constrictors, Log Jams, Log Sills, and Live Branch Layering

Each rootwad, deflector log, channel constrictor, log jam, and log sill structure should be inspected to see if the structure has moved from its original placement. Each structure should be inspected for any signs of instability. The live branch layering along the slopes of the channel should be examined for signs of erosion. If any of the above conditions are detected, maintenance should be performed as follows:

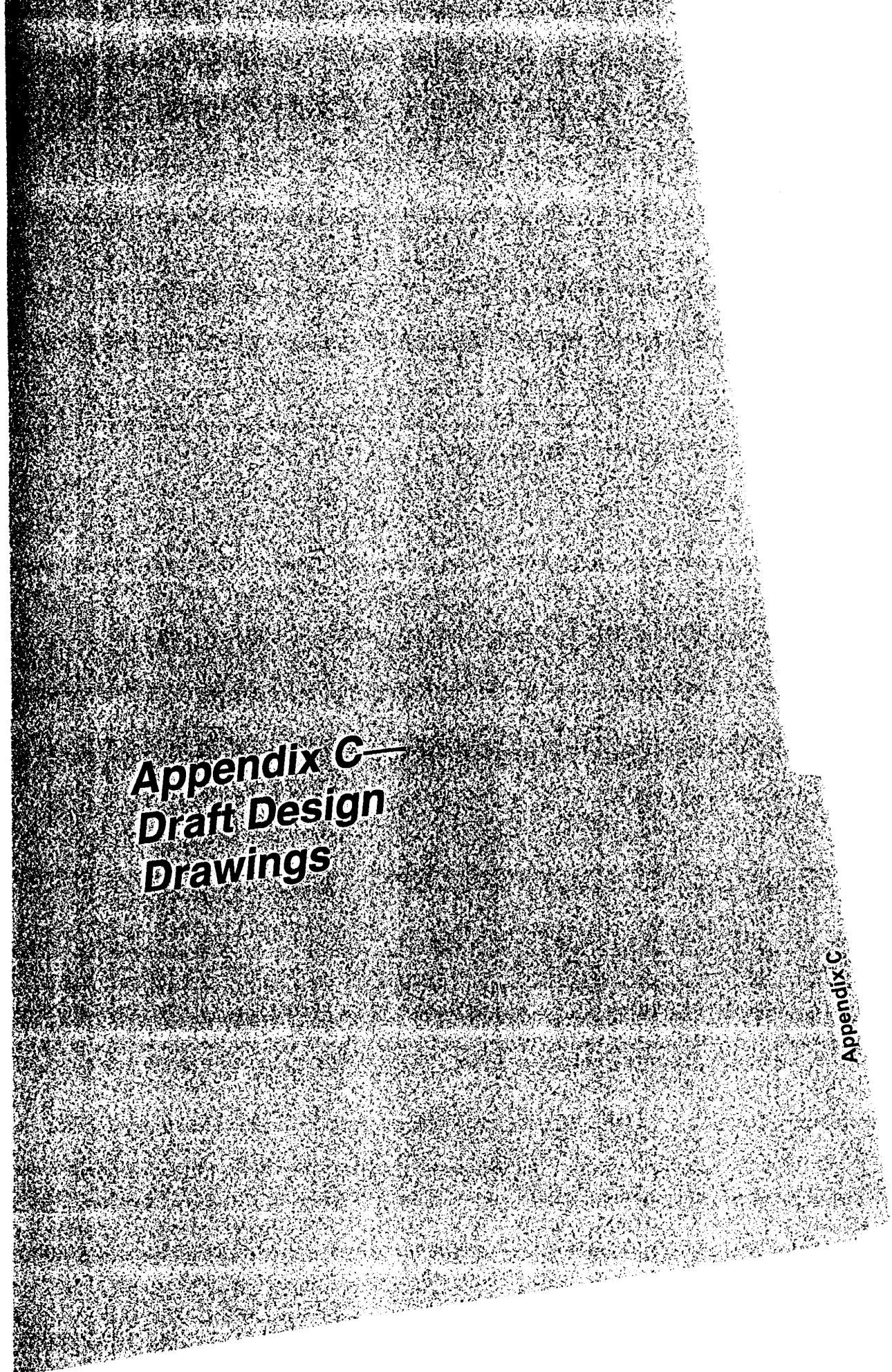
- Movement of a bioengineered structure: The structure should be moved back to its original place and additional cable and/or rebar should be used to secure the structure.
- Instability of a bioengineered structure: The structure should be secured with additional cable and/or rebar.
- Bank erosion: The cause of the erosion should be evaluated and the appropriate measures taken to stop further erosion from occurring. Repairs to the live branch layering should occur as appropriate (i.e., reinforcing the installation of the geotextile material used in the live branch layering or securing the live cuttings within the banks).

Log Weirs and Concrete Weir

Each log and concrete weir should be inspected to ensure that it is properly functioning and secure within the channel bank. Any signs of instability should be reported to the project engineer and, upon instructions from the engineer, appropriate measures should be taken. Additionally, any debris that has accumulated on the log weir should be removed.

Boulders

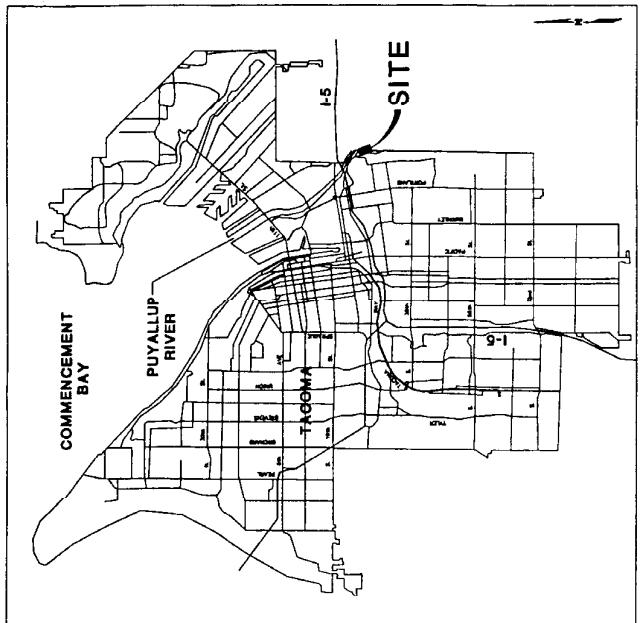
Any large debris should be removed from the boulders. The location of the boulders should be inspected and if movement of the boulders has occurred, the project engineer should determine if the boulders need to be moved back to the original location.



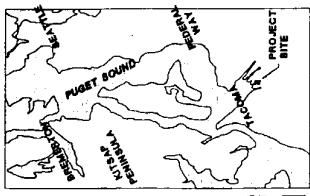
Appendix C

Draft Design Drawings

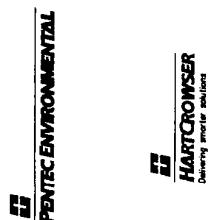
Appendix C



VICINITY MAP



AREA MAP



CITY OF TACOMA
DEPARTMENT OF
PUBLIC WORKS

WORK ORDER DC 1095
SWAN CREEK
STREAM RESTORATION PROJECT
SPECIFICATION NO. G-219-00

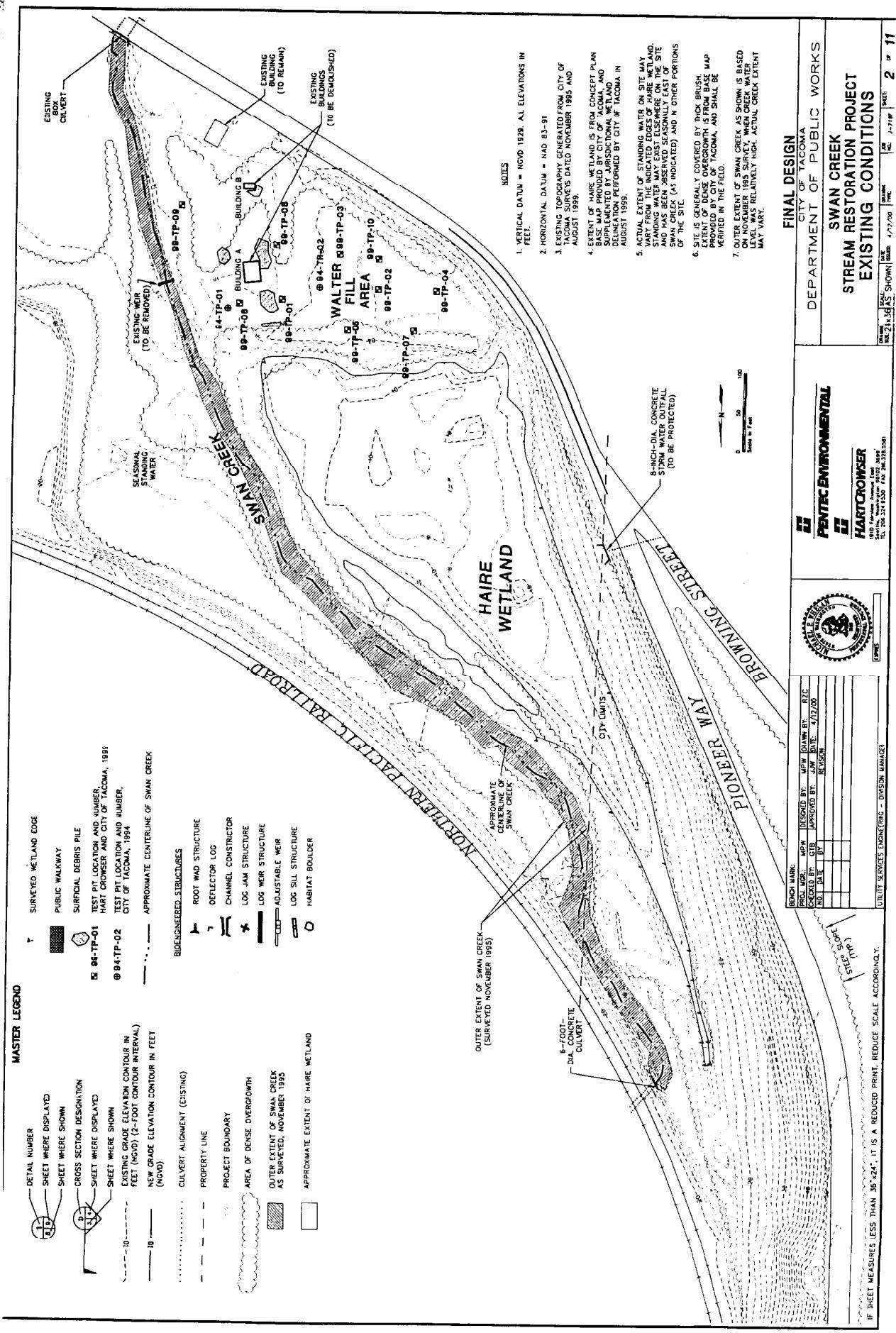
FINAL DESIGN

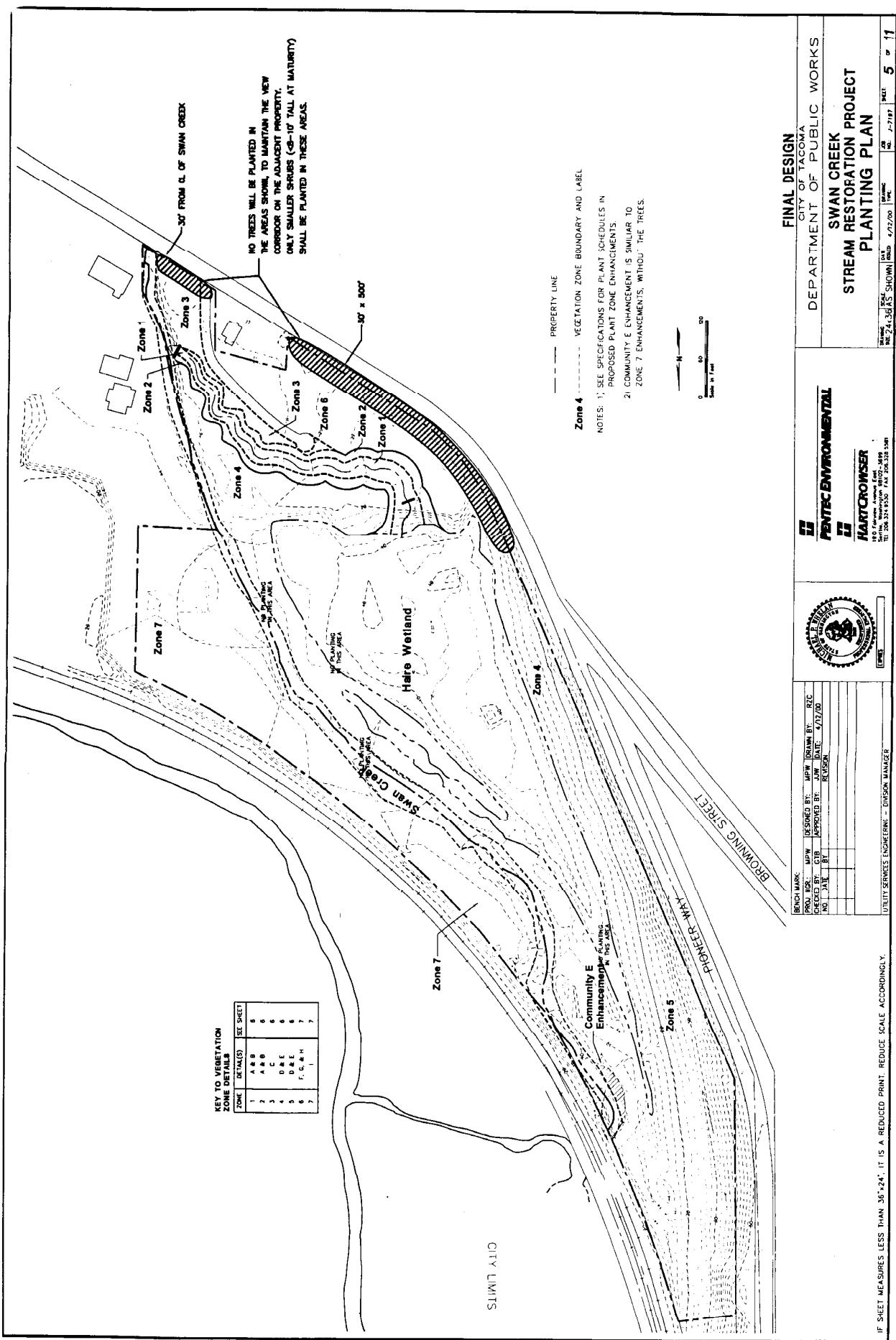
SHEET INDEX

- 1 TITLE SHEET
- 2 EXISTING CONDITIONS
- 3 CONSTRUCTION PLAN
- 4 PROFILES AND CROSS SECTIONS
- 5 PLANTING PLAN
- 6 PLANTING DETAILS (SHEET 1 OF 2)
- 7 PLANTING DETAILS (SHEET 2 OF 2)
- 8 DETAILS (SHEET 1 OF 3)
- 9 DETAILS (SHEET 2 OF 3)
- 10 DETAILS (SHEET 3 OF 3)
- 11 EROSION AND SEDIMENT CONTROL PLAN

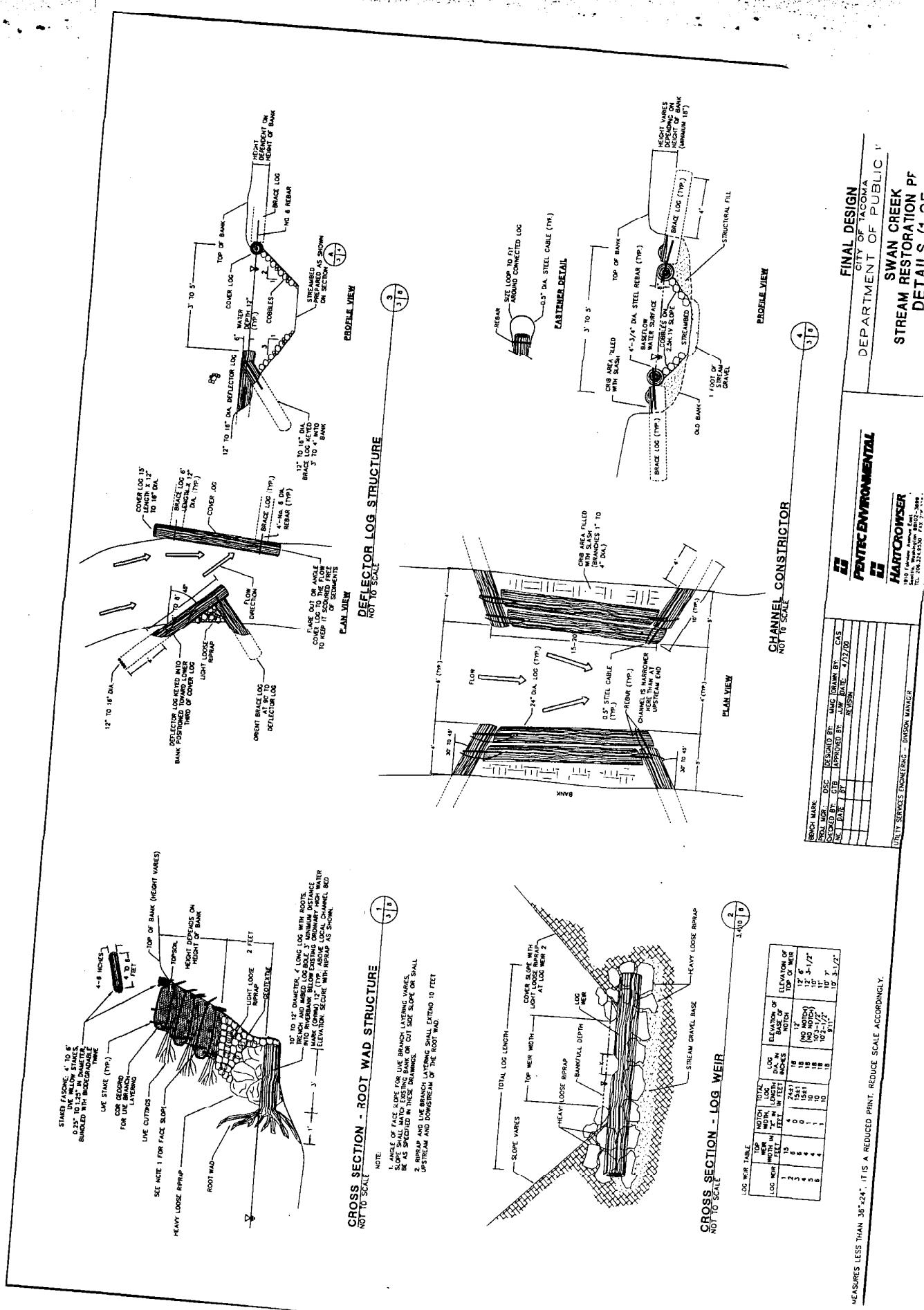
IF SHEET MEASURED LESS THAN 36" X 24", IT IS A REDUCED PRINT. REDUCE SCALE ACCORDINGLY.

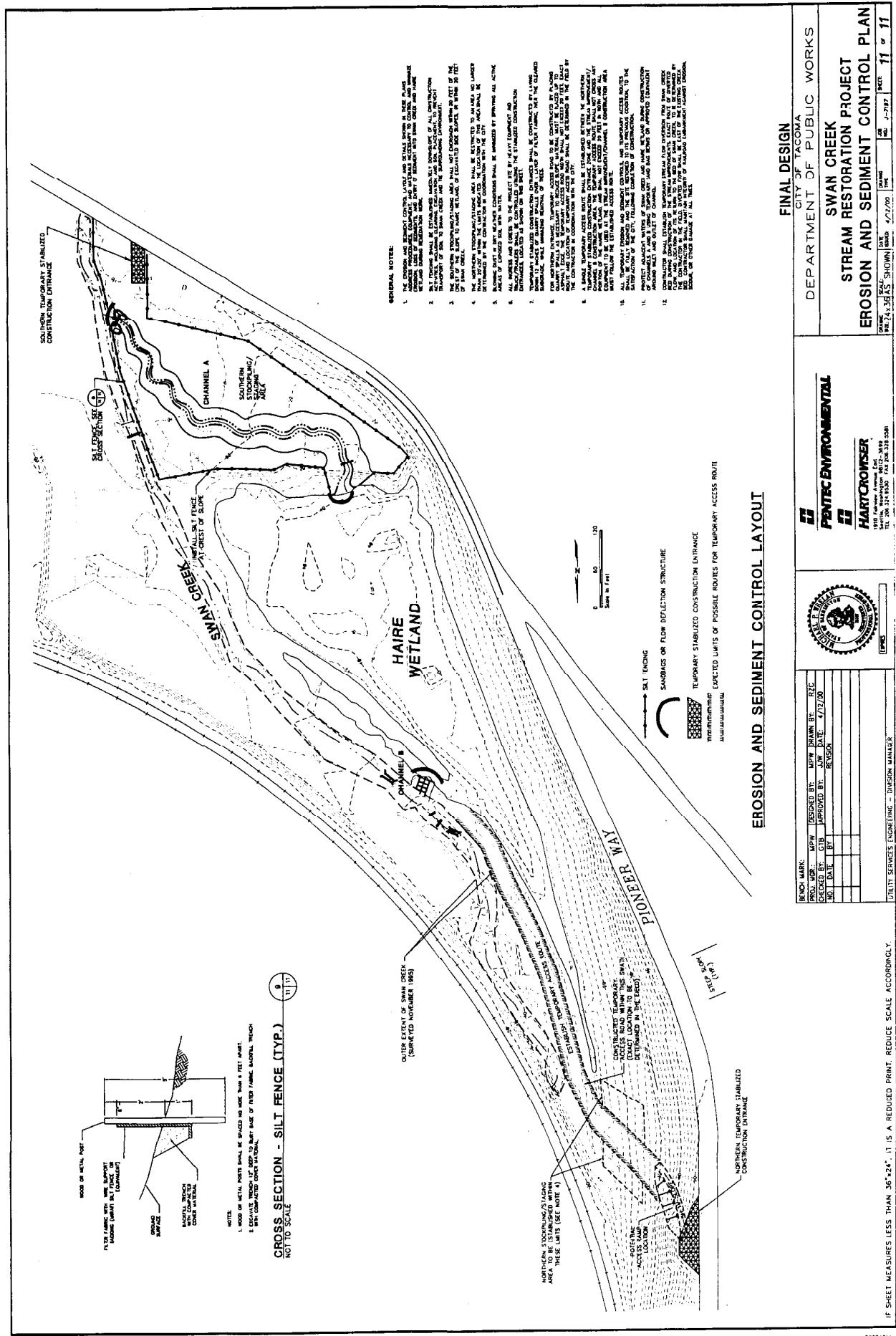
FINAL DESIGN	
CITY OF TACOMA	
DEPARTMENT OF PUBLIC WORKS	
SWAN CREEK	
STREAM RESTORATION PROJECT	
TITLE SHEET	
REF ID:	DC-1095
DESIGNER:	MPW
APPROVED BY:	RJC
DATE:	4/2/00
REVISION:	
NO:	
BY:	
SHEET MARK	
PROJ. USE:	MPW
CHECKED BY:	GTB
DATE:	
NO:	
DETAILS	
1	DETAIL 1 OF 3
2	DETAIL 2 OF 3
3	DETAIL 3 OF 3
PRINTING	
PRINTING AREA:	14.7" X 20.5"
PRINTING SIZE:	14.7" X 20.5"
PRINTING DATE:	4/2/00
PRINTING TIME:	10:00 AM
PENTEC ENVIRONMENTAL	
HARTCROWSER	
UIC Company, Inc. 1000 1st Avenue, Suite 1000 Seattle, WA 98101-3120 Tel: 206.467.5450 Fax: 206.467.5455	
PRINTED ON 4/2/00 BY SWAN CREEK STREAM RESTORATION PROJECT	
PAGE 1 OF 11	





IF SHEET MEASURES LESS THAN 36" x 24", IT IS A REDUCED PRINT. REDUCE SCALE ACCORDINGLY.





IF SHEET MEASURES LESS THAN 36" x 24". IT IS A REDUCED PRINT. REDUCE SCALE ACCORDINGLY.

NOTES:
 1) SEE PLANT MATERIAL SCHEDULE FOR
 PLANT QUANTITIES, SIZES, AND SPACING.
 2) INTERPOSE SMALL GROUPS OF
 CEDAR AND DOUGLAS FIR ON THE
 CHANNEL BANKS. DO NOT PLANT
 WHITE RIVERINE SPECIES AND REARROW
 RETAIN TO PLANTING OF ZONE 4 AND 5.
 PLANT SCHEDULES OF ZONES 4 AND 5.

ZONE 5 (ABOVE 20' CROWN)

EXISTING HARDWOODS

ZONE 4 (BELLOW 20' CROWN)

PIONEER WAY

BURNING STREET

REMOVAL
RIVERINE
SPECIES

ZONE 5

ABOVE

20'

CROWN

ZONE 4

BETWEEN

20'

CROWN

ZONE 3

BELOW

20'

CROWN

ZONE 2

ABOVE

20'

CROWN

ZONE 1

BELOW

20'

CROWN

ZONE 1

ABOVE

**Appendix D—
Plant Materials
Schedule**

Plant Material Schedule - Zone 1 (Constructed Stream Channel)

Scientific Name	Common Name	Quantity	Spacing	Size/Condition	Planting Instructions
Trees					
<i>Fraxinus latifolia</i>	Oregon ash	30	Irregular	2 gal. cont.	Individuals between groups of shrubs
<i>Salix lucida</i> ssp. <i>lasiandra</i>	Pacific willow	20	Irregular	1 gal. cont. or RC	Plant individual plants between groups of shrubs at or within ~3 ft of the ordinary high water mark (OHWM)
	Subtotal	50			
Shrubs					
<i>Cornus sericea</i>	Red-osier dogwood	80	6-9 ft o.c.*	2-3 ft live stakes	3-5 groups of 3-5 live stakes ea. or 1 gal. cont. at to about 6 ft. above the OHWM.
<i>Cornus sericea</i>	Red-osier dogwood	80	6-9 ft o.c.	1 gal. cont. or RC	Small groups of 3-5 plants at to ~3 ft above OHWM
<i>Lonicera involucrata</i>	Black twinberry	120	3.5 ft o.c.	1 gal. cont. or RC	Small groups of 3-5 plants at to ~4 ft above OHWM
<i>Physocarpus capitatus</i>	Pacific ninebark	100	6-9 ft o.c.	1 gal. cont.	Plant in groups of 3-5 stakes spaced 3-6 ft o.c.
<i>Salix sitchensis</i>	Sitka willow	160	3-6 ft o.c.*	2-3 ft live stakes	Intersperse and offset with groups of Hooker willow, black twinberry, and red-osier dogwood.
<i>Salix hookeriana</i>	Hootier willow	160	3-6 ft o.c.	2-3 ft live stakes	3-5 groups of 3-5 live stakes ea. at or near OHWM
	Subtotal	700			
	Total	750			

* - spacing for groups of live stakes as specified in the planting instructions.

RC - rooted cutting

Plant Material Schedule - Zone 2 (Constructed Stream Channel)

Scientific Name	Common Name	Quantity	Spacing	Size/Condition	Planting Instructions
Trees					
<i>Alnus rubra</i>	Red alder	44	8-15 ft. o.c.	BR, RC, or 1 gal. cont.	Plant in groups with other hardwoods 8 to 15 ft. o.c.
<i>Fraxinus latifolia</i>	Oregon ash	30	8-15 ft. o.c.	2 gal. cont.	Plant in groups with other hardwoods 8 to 15 ft. o.c.
<i>Picea sitchensis</i>	Sitka spruce	24	8-20 ft. o.c.	2-3 ft. BR or 2 gal. cont.	Plant in groups with other conifers 8 to 20 ft. o.c.
<i>Pseudotsuga menziesii</i>	Douglas fir	12	8-20 ft. o.c.	2-3 ft. BR or 2 gal. cont.	Plant in dense groups in and around individual trees within ex. hardwoods
<i>Salix scouleriana</i>	Scouler willow	24	6-9 ft. o.c.	1 gal. cont. or RC	and intersperse individual trees within ex. hardwoods
<i>Tsuga heterophylla</i>	Western hemlock	12	8-20 ft. o.c.	2-3 ft. BR or 2 gal. cont.	Sm groups of 2-3 upslope of shrubs in Zone 1.
	Subtotal	146			Sm groups with other conifers & within ex. hardwoods
Shrubs					
<i>Acer circinatum</i>	Vine maple	85	6-9 ft. o.c.	BR or 2 gal. cont.	Groups of 3-5 plants, esp. in shaded areas of ex. black cottonwood that will be retained.
<i>Rubus spectabilis</i>	Salmonberry	116	3-6 ft. o.c.	1 gal. cont.	Plant in dense groups in and around hardwoods
<i>Sambucus racemosa</i>	Red elderberry	46	6-9 ft. o.c.	BR or 1 gal. cont.	Sm groups of 3-5 plants at 2 to 2.5 ft above OHWM
<i>Symporicarpus albus</i>	Snowberry	94	3-6 ft. o.c.	BR or 1 gal. cont.	Plant in a narrow band near the top of bank.
	Subtotal	341			
	Total	487			

BR - bare root

BR - bare root
BC - rooted cuttings

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Plant Material Schedule - Zone 3 (Public Aces)

Scientific Name	Common Name	Quantity	Spacing	Size/Condition	Planting Instructions
Trees					
<i>Alnus rubra</i>	Red alder	4	8-12 ft o.c.	BR, RC, or 1 gal. cont.	Small groups per typical planting detail
<i>Arbutus menziesii</i>	Madrone	12	8-15 ft o.c.	4-5 ft BB or 5 gal. cont.	Plant in groups per planting detail
<i>Cornus nuttallii</i>	Nuttall's dogwood	5	Irregular	4-5 ft BB or 2 gal. cont.	Sm. groups & scattered individuals as shown in typical planting detail.
<i>Populus balsamifera</i> ssp. <i>trichocarpa</i>	Black cottonwood	7	8-15 ft o.c.	BR, RC, or 1 gal. cont.	Small groups per typical planting detail
<i>Prunus emarginata</i>	Bitter cherry	10	6-8 ft o.c.	2-3 ft. BR or 2 gal. cont.	Small groups per typical planting detail
<i>Picea sitchensis</i>	Sitka spruce	4	8-20 ft o.c.	2-3 ft. BR or 2 gal. cont.	Plant Sitka spruce, Douglas fir, and western red cedar, and western hemlock in groups of 2-13 trees and as scattered individuals as shown in the typical planting detail.
<i>Pseudotsuga menziesii</i>	Douglas fir	18	8-20 ft o.c.	2-3 ft. BR or 2 gal. cont.	
<i>Thuja plicata</i>	Western red cedar	6	8-20 ft o.c.	2-3 ft. BR or 2 gal. cont.	
<i>Tsuga heterophylla</i>	Western hemlock	7	8-20 ft o.c.	2-3 ft. BR or 2 gal. cont.	
		Subtotal	73		
Shrubs					
<i>Corylus cornuta</i>	Beaked hazelnut	15	6-9 ft o.c.	2-3 ft. BR or 2 gal. cont.	Plant in groups per typical planting detail.
<i>Crataegus douglasii</i>	Douglas' hawthorn	27	6-9 ft o.c.	2-3 ft. BR or 1 gal. cont.	Plant in groups to deter access to channel.
<i>Gaultheria shallon</i>	Salal	54	3-5 ft o.c.	4" pot or 6-12" BR	Plant in groups per typical planting detail.
<i>Mahonia aquifolium</i>	Tall Oregon grape	59	3-6 ft o.c.	1-2 ft. BR or 1 gal. cont.	Arrange tall Oregon grape, western crabapple, pink-flowering currant, and Nootka rose in groups along public walkway for aesthetics & to deter access and trampling of streambanks.
<i>Malus fusca</i>	Western crabapple	17	6-9 ft o.c.	2-3 ft. BR or 1 gal. cont.	
<i>Ribes sanguineum</i>	Pink-flowering currant	23	3-6 ft o.c.	1-2 ft. BR or 1 gal. cont.	
<i>Rosa nutkana</i>	Nootka rose	57	3-6 ft o.c.	1-2 ft. BR or 1 gal. cont.	
		Subtotal	252		
		Total	325		

BR - bare root

BB - ball & burlap
RC - rooted cutting

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Plant Material Schedule - Zone 4 (Riparian Reforestation)

Scientific Name	Common Name	Quantity	Spacing	Size/Condition	Planting Instructions
Trees					
<i>Picea sitchensis</i>	Stika spruce	67	8-15 ft. o.c.	4-6 ft. BB or 5 gal. cont.	Plant in small stands of 5-15 to create mixed aged stands of conifers amid stands of hardwoods, esp. in areas where invasive species such as Himalayan blackberry are removed.
<i>Picea sitchensis</i>	Stika spruce	67	8-15 ft. o.c.	1.5-2 ft. BR or 1 gal. cont.	
<i>Thuja plicata</i>	Western red cedar	68	8-15 ft. o.c.	4-6 ft. BB or 5 gal. cont.	
<i>Thuja plicata</i>	Western red cedar	72	8-15 ft. o.c.	1.5-2 ft. BR or 1 gal. cont.	
<i>Tsuga heterophylla</i>	Western hemlock	68	8-15 ft. o.c.	4-6 ft. BB or 5 gal. cont.	Plant western hemlock in drier portion of this zone near the constructed channel.
<i>Tsuga heterophylla</i>	Western hemlock	72	8-15 ft. o.c.	1-1.5 ft. BR or 1 gal. cont.	
		Total	414		
BB - ball & burlap BR - bare root					

Plant Material Schedule - Zone 5 (Riparian Reforestation)

Scientific Name	Common Name	Quantity	Spacing	Size/Condition	Planting Instructions
Trees					
<i>Abies grandis</i>	Grand fir	25	8-15 ft. o.c.	4-6 ft. BB or 5 gal. cont.	Plant in small stands of 5-15 and as scattered individuals to create mixed-aged stands of conifers amid stands of existing hardwoods.
<i>Abies grandis</i>	Grand fir	50	8-15 ft. o.c.	1.5-2 ft. BR or 1 gal. cont.	
<i>Pseudotsuga menziesii</i>	Douglas fir	20	8-15 ft. o.c.	1.5-2 ft. BR or 2 gal. cont.	
<i>Tsuga heterophylla</i>	Western hemlock	25	8-15 ft. o.c.	4-6 ft. BB or 5 gal. cont.	
<i>Tsuga heterophylla</i>	Western hemlock	53	8-15 ft. o.c.	1-1.5 ft. BR or 1 gal. cont.	
		Total	173		
BR - bare root					

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Plant Material Schedule - Zone 6 (Riparian Reforestation)

Scientific Name	Common Name	Quantity	Spacing	Size/Condition	Planting Instructions
Trees					
<i>Acer macrophyllum</i>	Big-leaf maple	20	Irregular	2 gal. cont.	Solitary or groups of two trees per typ. detail.
<i>Acer macrophyllum</i>	Big-leaf maple	40	Irregular	BR or 1 gal. container	Use larger trees in full sun.
<i>Arbutus menziesii</i>	Madrone	30	Irregular	4-5 ft BB or 5 gal. cont.	As shown in planting detail for Zone PA
<i>Pseudotsuga menziesii</i>	Douglas fir	20	8-20 ft. o.c.	1.5-2 ft. BR or 2 gal. cont.	Individuals or small groups in open areas.
<i>Thuja plicata</i>	Western red cedar	20	8-20 ft. o.c.	2 gal. cont.	Plant small groups of each species alone
<i>Thuja plicata</i>	Western red cedar	40	8-20 ft. o.c.	BR or 1 gal. cont.	and together in mixed groups and as
<i>Tsuga heterophylla</i>	Western hemlock	40	8-20 ft. o.c.	1-1.5 ft. BR or 1 gal. cont.	solitary trees. Use larger trees in full
<i>Tsuga heterophylla</i>	Western hemlock	20	8-20 ft. o.c.	2 gal. container	sunlight to help reduce regrowth of weeds.
	Subtotal	230			
Shrubs					
<i>Acer circinatum</i>	Vine maple	144	6-9 ft. c.c.	BR or 2 gal. cont.	Plant in groups per typical planting detail.
<i>Corylus cornuta</i>	Beaked hazelnut	90	6-9 ft. c.c.	1 gal. container	Plant in groups per typical planting detail.
<i>Gaultheria shallon</i>	Salal	256	3-6 ft. c.c.	4" pot or 6-12" BR	Plant in groups in both full sunlight and partial shade per typical planting details.
<i>Holodiscus discolor</i>	Oceanspray	136	6-9 ft. c.c.	1 gal. cont.	Plant in groups per typical planting detail.
<i>Vaccinium ovalatum</i>	Evergreen huckleberry	191	3-6 ft. c.c.	BR or 1 gal. container	Plant in groups per typical planting detail.
	Subtotal	817			
Herbs					
<i>Polystichum munitum</i>	Swordfern	82	3-6 ft. c.c.	1 gal. cont.	Plant around conifers.
	Subtotal	82			
	Total	1129			

BR - bare root

BB - ball & burlap

Plant Material Schedule - Zone 7 (Riparian Reforestation)

Scientific Name	Common Name	Quantity	Spacing	Size/Condition	Planting Instructions
Trees					
<i>Picea sitchensis</i>	Sitka spruce	34	Irregular	4-6 ft BB or 5 gal. cont.	Individual or groups of 2 trees scattered in among small stands of black cottonwood.
<i>Populus balsamifera</i> ssp <i>trichocarpa</i>	Black cottonwood	85	8-15 ft o.c.	RC or 1 gal. cont.	plt. in small stands or groups of 3-8 trees
	Subtotal	119			
Shrubs					
<i>Cornus sericea</i>	Red-osier dogwood	732	6-9 ft o.c.	3-5 ft live stakes	3-5 plants in irregularly-spaced groups
<i>Salix sitchensis</i>	Sitka willow	732	6-9 ft o.c.	3-5 ft live stakes	3-5 plants in irregularly-spaced groups
	Subtotal	1,464			
	Total	1,583			

BB - ball & burlap
RC - rooted cutting